SECTION M9

MISCELLANEOUS MATERIALS

M9.00.0 General.

All materials in this category shall be sampled and tested in accordance with the standard methods applicable to that particular material.

M9.01.0 Calcium Chloride.

Calcium Chloride shall conform to the requirements of AASHTO M 144, Type I or Type II.

M9.01.1 Sodium Chloride.

Sodium Chloride to be used for road purposes shall conform to the requirements of AASHTO M 143, except that the grading shall conform to the following:

Sieve	Percent Passing
9.5 mm	100
4.75 mm	82 maximum
2.36 mm	50 maximum
600 µm	7 maximum

M9.02.0 Herbicides.

These specifications cover chemicals used to destroy and/or control the growth of plants both indiscriminately (non-selective herbicides) and selectively (selective herbicides). Only those herbicides currently approved by the State Pesticide Board and the Department may be used.

M9.03.0 Insecticides.

These specifications cover chemicals to be used in the control of insects which are harmful to trees and desirable growth. Only those insecticides currently approved by the State Pesticide Board and the Department may be used.

M9.04.0 Curb and Edging.

All granite curb and edging shall be basically light gray in color, free from seams and other structural imperfections or flaws which would impair its structural integrity, and of a smooth splitting appearance. Natural color variation characteristic of the deposit from which the curbing is obtained will be permitted.

Whenever curbing is sawed, all surfaces that are to be exposed shall be thoroughly cleaned and any iron rust or iron particles removed by sand blasting or other approved methods satisfactory to the Engineer and any saw mark in excess of 3 millimeters shall be removed.

M9.04.1 Granite Curb.

The stones for the several types of granite curb shall be cut to the dimensions and curvature hereinafter stated:

Type	Minimum Length (m)	Width at Top (mm)	Depth (mm)	Minimum Width at Bottom (mm)
VA1	2	175	425 - 475	100 (for 2/3 length)
VA2	2	175	475 - 525	100 (for 2/3 length)
VA3	2	150	475 - 525	100 (for 2/3 length)
VA4	2	150	425 - 475	100 (for 2/3 length)
VA5	1.5 150		See Plans	100 (for 2/3 length)
VB	1.0	125	375 - 425	90 (for 2/3 length)

Except for the three (3) following conditions, ten percent of the length of each type of VA curb installed on the project may consist of stones no more than 150 millimeters shorter than the length specified in either table.

1. Stones used in making closures may be as much as one third shorter than specified in either table, except that for VA5 the closure piece shall have a minimum length of 1.2 meters.
2. Stones used in making closures on bridge decks at paraffin joints may have one piece, no less than 1.2 meters between any two paraffin joints or between one paraffin joint and the end of the run of curbing.
3. On curves with radii greater than 30 meters but less than 150 meters, type VA stones may be 1.2 meters to not more than 2 meters in length.

Type VA stones to be set on a radius of 30 meters or less shall be cut to the required curvature unless otherwise directed and except for making closures shall be of minimum lengths as follows:

Radius (m)	Minimum Length (m)
15 to 30	2.0
7.5 to less than 15	1.5
Less than 7.5	1.0

Type VB stones to be set on a radius of 30 meters or less shall be cut to the required curvature unless otherwise directed.

All VB stones shall have a minimum length of 1 meter regardless of curvature.

The ends of all curved stones shall be cut on radial lines.

Finish

The finish and surface dimensions for the several types of curb shall conform to the following requirements:

A. Type VA Curb.

This type of curbstone shall have a top surface free from wind, shall be peen hammered or sawed to an approximately true plane, and shall have no projections or depressions greater than 3 millimeters. The front and back arris lines shall be pitched straight and true and there shall be no projection on the back surface for 75 millimeters down from the top which would exceed a batter of 3:1 (3 vertical:1 horizontal) when measured in the in-place position, except on VA5 the back surface shall have no projection or depression greater than 38 millimeters.

The front face shall be at right angles to the planes of the top and ends and shall be smooth quarry split, free from drill holes and with no projection of more than 25 millimeters and no depression of more than 13 millimeters measured from the vertical plane of the face through the arris or pitch line for a distance down from the top of 200 millimeters for types VA1 and VA4, 250 millimeters for VA2 and VA3, and the full depth of VA5. For the remaining distance there shall be no projection or depression greater than 25 millimeters measured in the same manner.

The ends of all stones shall be square with the planes of the top and face so that when the stones are placed end to end as closely as possible no space shall show in the joint at the top and face of more than

13 millimeters for the full width of the top and for 200 millimeters down on the face for Type VA1 and VA4, 250 millimeters for VA2 and VA3, and the full depth of VA5, after which the end may break back not over 200 millimeters from the plane of the joint. The arris formed by the intersection of the plane of the joint with the planes of the top and exposed faces shall have no variation from the plane of the top and exposed faces greater than 3 millimeters.

B. Type VB Curb.

This type of curbstone shall have a top surface free from wind, shall be pointed, peen hammered or sawed to an approximately true plane and shall have no projections or depressions greater than 5 millimeters. The front and back arris lines shall be pitched straight and true.

The front face shall be at right angles to the plane of the top, and shall be smooth quarry split, free from drill holes and with no projection of more than 40 millimeters and no depression greater than 25 millimeters measured from the vertical plane of the face through the arris or pitch lines for the full depth of the face.

The ends of all stones shall be square with the planes of the top and face so that when stones are placed end to end as closely as possible no space shall show in the joint in the top and face of more than 13 millimeters for the full width of the top and 200 millimeters down on the face after which the ends may break back not more than 300 millimeters from the plane of the joint. On pieces less than 1.2 meters in length, the ends shall not break back more than 225 millimeters. The arris formed by the intersection of the plane of the joint with the planes of the top and exposed faces shall have no variation from the plane of the top and exposed faces greater than 3 millimeters.

M9.04.2 Granite Edgestone.

The stones for the several types of edging shall be cut to the dimensions given in the following table:

	Type SA	Type SB	Type SC
Minimum Length (m)	0.90	0.60	0.30
Maximum Length (m)	2	2	2
Thickness (mm)	125 to 200	75 to 150	75 to 150
Width of Face (mm)	300	280 to 330	280 to 330

When the edging is used on a curve of 50 meter radius or less the length shall be as directed by the Engineer except that where the edging is to be set on a radius of 3 meters the maximum length shall be 300 millimeters.

Finish.

Type SA Edging.

The exposed face shall be smooth quarry split to an approximately true plane having no projections or depressions which will cause over 25 millimeters to show between a 600 millimeters straight-edge and the face when the straight-edge is placed as closely as possible on any part of the face.

If projections on the face are more than that specified they shall be dressed off. The top and bottom lines of the face shall be pitched off to a straight line and shall not show over 15 millimeters between stone and straight-edge when straight-edge is placed along the entire length of the top and bottom lines and when viewed from a direction at right angles to the plane of the face, and for the top line only not over 15 millimeters when viewed from a direction in the plane of the face. The ends shall be square to the length at the face and so cut that when placed end to end as closely as possible no space shall show in the joint at the face of over 20 millimeters, except that where the edging is to be used on a curve having a radius of 3 meters or less the ends of the stones shall be so cut as to provide a finished joint at the face of not more than 15 millimeters. The arris formed by the intersection of the plane of the face with the plane of the end joint shall not vary from the plane of the face or the plane of the joint more than 6 millimeters. Drill holes may show on the exposed face but only along the bottom edge. The sides shall not be broken under the square more than 100 millimeters and the side adjacent to the grass shall not project over 25 millimeters.

Type SB Edging.

The exposed face shall be smooth quarry split to an approximately true plane having no projections or depressions which will cause over 25 millimeters to show between a 600 millimeter straight-edge and the face when the straight-edge is placed as closely as possible on any part of the face.

If projections on the face are more than that specified they shall be dressed off. The top and bottom lines of the face shall be pitched off to a straight line and shall not show over 25 millimeters between stone and straight-edge when straight-edge is placed along the entire length of the top and bottom lines and when viewed from a direction at the right angles to the plane of the face, and for the top line only not over 25 millimeters when viewed from a direction in the plane of the face. The ends shall be square to the length at the face and so cut that when placed end to end as closely as possible, no space shall show in the joint at the face of over
40 millimeters, except that where the edging is to be used on a curve having a radius of 3 meters or less the ends of the stones shall be so cut as to provide a finished joint at the face section of not more than 15 millimeters. The arris formed by the intersection of the plane of the face with the plane of the end joint shall not vary from the plane of the face more than 6 millimeters. Drill holes not more than 90 millimeters in length and
15 millimeters in depth will be permitted. The sides shall not be broken under the square more than
100 millimeters and the side adjacent to the grass shall not project over 25 millimeters.

Type SC Edging.

The exposed face shall be smooth quarry split to an approximately true plane having no projections or depressions which will cause over 15 millimeters to show between a 600 millimeter straight-edge and the face when the straight-edge is placed as closely as possible on any part of the face. If projections on the face are more than that specified they shall be dressed off. The top and bottom lines of the face shall be pitched off to a straight line and shall not show over 25 millimeters between stone and straight-edge when straight-edge is placed along the entire length of top and bottom lines and when viewed from a direction at right angles to the plane of the face, and for the top line only, not over 25 millimeters when viewed from a direction in the plane of the face. The ends shall be square to the length at the face and so cut that when placed end to end as closely as possible no space shall show in the joint at the face of over 40 millimeters, except that where the edging is to be used on a curve having a radius of 3 meters or less the ends of the stones shall be so cut as to provide a finished joint at the face of not more than 15 millimeters. The arris formed by the intersection of the plane of the face with the plane of the end joint shall not vary from the plane of the face more than 6 millimeters. Drill holes not more than 90 millimeters in length and 15 millimeters in depth will be permitted. The sides shall not be broken under the square more than 100 millimeters and the side adjacent to the grass shall not project over
25 millimeters.

M9.04.4 Field Stone Masonry.

Stone for field stone masonry shall consist of sound durable blasted or field stone free from seams, cracks and other structural defects and of an approved and satisfactory quality and shape.

The stone shall have straight edges without re-entrant angles. The faces shall be flat but not necessarily rectangular in shape.

Individual stone shall have, when set in the wall, no face dimension less than 200 millimeters. Stretchers shall have a depth in the wall at least 1-1/2 times the rise, and a length on the face at least twice the rise. Headers shall have a length on the face at least equal to the rise. Headers shall hold in the heart of the wall the same size as shown on the face and shall extend at least 300 millimeters more than the stretchers into the backing.

When Field Stone Masonry in Cement Mortar is specified, mortar shall conform to the requirements of Subsection M4.02.15.

M9.04.5 Granite Curb Inlets.

The granite for curb inlet shall conform to M9.04.0. It shall have a horizontal bed and the top shall be free from wind. The stone shall be sawn or peen hammered on top and the front and back edges shall be pitched true to line. The back face for a distance of 75 millimeters down from the top shall have no projection greater than 25

millimeters. The front face shall be straight split, free from drill holes, and it shall have no projections greater than 25 millimeters or depression greater than 15 millimeters for a distance of
250 millimeters down from the top, and for the remaining distance there shall be no depression or projection greater than 25 millimeters. The ends shall be squared with the top for the depth of the face finish and so cut that the curb inlet can be set with joints of not more than 15 millimeters.

The granite curb inlet shall be 2 meters in length, plus or minus 15 millimeters, from 425 to
475 millimeters in depth, 150 millimeters wide at the top and at least 150 millimeters wide at the bottom.

Curb inlets to be set on a radius of 50 meters or less shall be cut to the curve required, unless otherwise directed by the Engineer. The joints of all curved curb inlets shall be cut on radial lines.

A gutter mouth at least 75 millimeters in depth and at least 600 millimeters in length shall be cut in the front face of the stone as shown on the plans.

Granite curb inlets shall match the adjacent curbing in color.

M9.04.6 Granite Curb Corners.

The granite for curb corners shall conform to M9.04.0 and shall have horizontal beds. They shall match the adjacent curbing in size, color and quality. The front arris lines shall extend through 1/4 of a circle having a radius of 600 or 900 millimeters respectively for Type A or Type B Curb Corner. The back arris line shall be straight. The plane of back shall be normal to top.

M9.04.8 Granite Bounds.

Granite bounds shall be of sound granite, the top and bottom faces parallel and the front and back shall be straight split. The bounds shall be cut to the dimensions shown on the plans and shall be plain or lettered as indicated on the plans or as directed.

The stone shall be pointed on the top and on three sides and hammer dressed on the face for a distance of not less than 300 millimeters below the top. The top shall be 150 millimeters square and shall have a drill hole in the center 40 millimeters in depth and 15 millimeters in diameter, with the bottom somewhat flared.

M9.04.9 Dry Stone Masonry.

Stone for dry stone masonry shall be hard and durable and free from seams or other imperfections and of an approved quality and shape. No stone shall be less than 150 millimeters in its least dimension. The stone shall be roughly square on joint beds and faces.

M9.05.0 Lumber and Wood Sheeting.

Lumber and Wood Sheeting shall be sound Spruce, Douglas fir, white or yellow Lodgepole or Ponderosa pine, or western hemlock plank, planed on one side and either tongue and grooved or splined. Lumber sheeting shall not be less than nominal 100 millimeters thick. Wood sheeting shall not be less than nominal 50 millimeters thick.

M9.05.1 Treated Timber.

Treated timber shall meet AASHTO M 133 except that only material meeting current EPA or DEP regulations will be allowed.

The properties of the timber selected for preservative treatment shall conform to the requirements of AASHTO M 168, Structural Timber, Lumber, and Piling.

M9.05.2 Wood Posts and Braces.

Wooden posts shall be round, well seasoned, straight, sound, cedar, oak, spruce or other approved wood not less than 100 millimeters in diameter, after the bark is removed. Timber braces shall be 100 millimeters square in

cross section.

The posts and braces shall be wholly treated with a preservative conforming to the requirements of AASHTO M 133.

M9.05.3 Wooden Rails and Posts.

Fences shall consist of wooden rails, braces and posts constructed as shown in the Department Standards.

Post for permanent barrier fences shall be select structural Douglas Fir or select structural spruce, well-seasoned, straight-grained, sound, planed on all sides and of the dimensions shown on the plans. Rails and braces shall be select structural longleaf yellow pine or select structural Douglas Fir well-seasoned, straight-grained, sound, planed on all sides and free from loose and unsound knots.

Post, rails and braces for portable barrier fences shall be select structural Douglas Fir or select structural longleaf yellow pine, well-seasoned, straight-grained, sound, planed on all sides and of the dimensions shown on the plans.

M9.05.4 Wooden Pegs.

Wooden pegs shall be wedge shaped and approximately 25 millimeters x 50 millimeters at the butt end and 250 millimeters or more in length as may be required.

M9.05.5 Timber Preservatives.

Timber preservatives shall conform to the requirements of AASHTO M 133. The method of treatment shall conform to American Wood-Preservers Association Standards C1, C2 and C3.

M9.05.6 Timber Piles.

A. General Requirements.

Timber piles shall conform to the requirements of ASTM D 25 and shall be cut from sound and live trees, preferably during the winter season. Piles shall be free from any defects which will impair their strength or usefulness for the purpose intended or that will prevent proper driving.

Unless otherwise specified, untreated timber piles shall have the bark unpeeled. Treated timber piles shall be clean-peeled so that all of the outer bark and at least 80% of the inner bark well distributed over the outer surface of the pile shall be removed. In order to obtain proper preservative treatment, no strips of inner bark wider than 15 millimeters shall remain.

All piles shall be cut above the ground swell, shall have a uniform taper from butt to tip end, and shall be free from short kinks. Knots or blemishes shall be trimmed off close and even with the body of the pile. A line from the center of the butt to the center of the tip must lie wholly within the body of the pile.

B. Inspection.

All piles will be subject to inspection before or after shipment to the site, or both, at the option of the Engineer. Any pile that does not conform to all the requirements will be rejected.

C. Specific Requirements.

The kind of timber to be used for treated piles will be Southern Yellow Pine or Douglas Fir and shall be treated in accordance with AWPA Standard C3 for CCA. All piles for which treatment is specified shall have not less than 25 millimeters of sapwood at the butt end for Douglas Fir and a 50 millimeter ring of sapwood at the butt end for Southern Pine.

Untreated piles shall be new spruce, oak, Douglas Fir, yellow pine, or any other species, subject to the approval of the Engineer, which will withstand the specified driving without injury.

Butt and tip dimensions for various lengths of piles shall be as set forth in the following table:

Length (m)	Minimum Dimension 1 Meter from Butt (mm)	Minimum Tip Dimension (mm)
Up to 12	300	200
12 and up to 15	300	175
15 and over	330	150

For all piles the maximum dimension 1 meter from the butt shall be 500 millimeters. Measurements are under the bark in all cases. Where the piles are to support a concrete cap, the maximum butt dimensions shall be 150 millimeters less than the designated width of the concrete cap.

Where piles are to be in line in a bent, all piles in the bent shall be of uniform size to permit the proper fastening of the bracing. Cutting of piles to accommodate the bracing will not be permitted.

D. Preservative Treatment.

Preservative treatment, when specified, shall conform to Subsection M9.05.5.

M9.06.0 Waterproof Paper Covers.

Waterproof paper covers shall conform to the requirements of AASHTO M 171. The name of the manufacturer shall be marked or imprinted clearly on the paper for proper identification.

M9.06.1 Polyethylene Covers.

A. Black Polyethylene Sheeting.

Black polyethylene sheeting suitable for use in covering storage piles of bulk or bag salt, or sand piles which have been blended with salt shall meet the requirements of NBS Product Standard PS-17.

The covers shall be 0.20 millimeters in thickness, black in color and contain suitable inhibitors to prevent deterioration due to sunlight and heat.

The sheeting shall be a minimum of 12 meters in width and a minimum of 30 meters in length. It shall be folded when packaged into rolls, so that the shipping width is not greater than 3 meters.

B. White Polyethylene Sheeting.

This material shall conform to the requirements of AASHTO M 171.

C. Reinforced Polyethylene Sheeting.

Reinforced Polyethylene Covers for stockpiles of salt and treated sand shall be reinforced with non-woven nylon or rayon cord, shall have a minimum tear strength of 490 Newtons in all directions, and shall weigh no less than 95 grams per square meter. They shall be black in color. The material shall be free from any additive which would reduce its resistance to water penetration or adversely affect the durability of the film. The covers shall contain suitable inhibitors to prevent deterioration due to sunlight and heat. They shall be a minimum of 12 meters in width and a minimum of 30 meters in length. They shall be folded when packaged into rolls, so that the shipping width is not greater than 3 meters.

M9.06.2 Tar Paper.

Tar impregnated felted paper shall conform to the requirements of ASTM D 227.

M9.06.3 Burlap.

Burlap shall conform to the requirements of AASHTO M 182, Class 3. It shall not have been used as a container for sugar or other substances deleterious to concrete and shall be in good condition, free from holes, tears, or other defects that would render it unsuitable for curing concrete. It shall be furnished in strips not less than 1 meter nor more than 2 meters in width and not more than 750 millimeters longer than the width of the pavement slab.

M9.06.4 Polyethylene Coated Burlap.

This material shall conform to the requirements of AASHTO M 17, White Burlap-Polyethylene Sheet.

M9.06.5 Impervious Liquid Membrane.

This material shall consist of an impervious liquid conforming to the requirements of AASHTO M 148, Type 1 or 2. When tested in accordance with AASHTO T 155, the liquid membrane forming compound shall restrict the loss of water present in the test specimen at the time of application of the curing compound to not more than 550 grams per square meter of surface after 3 days. When Type I is specified, it shall contain a fugitive dye.

M9.07.0 Plastic Waterstops.

Waterstops shall be fabricated from a plastic compound, the basic resin of which shall be polyvinyl chloride. The compound shall contain any additional resins, plasticizers, inhibitors or other materials such that when compounded it shall meet the performance requirements hereinafter specified.

Waterstops shall be extruded in such a manner that any cross section shall be dense, homogenous and free from porosity or other imperfections. The cross section of waterstops shall be as shown on Department Standard Details.

Physical Requirements.

The waterstops shall meet the following requirements:

1.	Tensile Strength, Die C, ASTM D 412	Min. 13.8 MPa
2.	Ultimate Elongation, Die C, ASTM D 412	Min. 250%
3.	Cold Bend Test (See Appendix I)	No Cracking
4.	Impact Resistance (See Appendix II)	No Cracking
5.	Resistance to Alkalis (See Appendix III)	No Cracking
	Increase in mass after 7 days	Max. 0.25%
	Increase in mass after 30 days	Max. 0.40%
	Decrease in mass after 7 days	Max. 0.10%
	Decrease in mass after 30 days	Max. 0.30%
	Change in dimensions after 30 days	Max. 1.00%
6.	Hardness Durometer (Shore A) ASTM D 2240	75 ± 5
7.	Water Absorption (48 hours) ASTM D 570	Max. 0.5% (by mass)

General Requirements.

The waterstops shall be spliced only at jointing made necessary by construction design.

Where joints are required, they shall be made in accordance with the manufacturer's instructions, without appreciable loss in strength, elasticity or permeability of the material.

The waterstop material shall be practically impervious to water and unaffected by most common acids, alkalis, sea water and mineral oils. The material shall be such that it will not engage in electrolytic action with steel, and will not discolor concrete.

The approved waterstop when properly installed, as in a concrete construction or expansion joint, shall be capable of maintaining a head of 23 meters of water without leakage.

Qualification Samples.

A manufacturer requesting approval of a waterstop shall furnish to the Research and Materials Section, 400 D Street, South Boston, Massachusetts 02110-1953, a 1 meter length of each type of waterstop he/she intends to supply and a certificate of analysis shall be furnished with the samples. The certificate shall state that the material furnished conforms without exception to all the requirements specified herein; and shall also include all qualitative and quantitative test results.

M9.08.0 Preformed Sheet Membrane.

Only products pre-approved by the Department will be accepted for use. Chemical composition, physical properties and dimensional requirements of the sheet membrane shall conform to the manufacturer's specifications for the material.

Also, all accessory materials such as, flashing, primer, etc., used in the application of the sheet membrane will be considered a part of this specification and shall conform to the manufacturer's requirements.

M9.09.0 Bentonite Waterproofing System.

Bentonite waterproofing system shall consist of a biodegradable corrugated kraft paper panel with flutes filled with sodium bentonite and ends sealed. The system shall also include trowel grade bentonite and protection board when necessary.

Panels shall meet the following specifications:

Bentonite content	4.9 kg/m^2 minimum
Panel thickness	5 mm
Panel dimensions	1200 mm x 1200 mm
Panel mass	8.2 kg minimum

Bentonite shall be pure, high swelling Wyoming sodium montmorillonite. The gel volume shall be 10 to 15 times dry volume and the swelling action shall be indefinitely reversible. The granular bentonite shall pass 90% through a 850 micrometer sieve and less than 10% through a 75 micrometer sieve. Mineralogical composition is 90% minimum montmorillonite with a 10% maximum native sediments of feldspars, mica, and unaltered volcanic ash. Proximate chemical analysis is silica 60%, alumina 20%, iron oxides 5%, magnesia 3%, soda 3% and lime 1%. It shall contain chemically bound water of 6% with minor of 2%.

When a joint seal is necessary it shall be bentonite hydrated to partial gel strength. In sub-freezing weather use a gel with glycol added.

The protection board (where required) shall be a puncture resistant 1200 millimeters x 1200 milli-meters x 1.6 millimeters multi-layer flexible board composed of pressure bonded cellulose fibers weighing approximately 830 grams per square meter.

M9.10.0 Jointing Materials for Pipes.

A. Jute or oakum furnished for use in pipe joints shall be of an accepted grade approved for common usage.

B. Mortar shall conform to the requirements of Section M4.02.15.

C. Rubber ring or plastic gaskets shall be of tough, flexible, chemical-resistant material, and of such size and shape as to ensure satisfactory pipe joints when incorporated in the work and shall conform to ASTM C 443.

D. Mechanical joints shall conform to the requirements of the ASA Specifications A21.11.

E. The yarning material for cast iron bell-and-spigot pipe joints shall be sterilized braided hemp or untarred twisted jute, clean and dry and free from oil, grease, or any other deleterious matter.

F. Clay pipe may also be joined using pipe having factory-cast mating collars of bituminous or plastic-resilient materials. These collars shall be of approved bituminous materials with demonstrated ability to make tight joints, of plastic-resilient materials conforming to ASTM C 425. Prior to jointing, bituminous joints shall be treated with a satisfactory non-oily solvent; plastic-resilient joints shall be treated with a satisfactory lubricant-adhesive, each supplied by the manufacturer.

M9.11.0 Insulation and Waterproof Jackets.

Where water pipe is installed or hung on structures, it shall be covered with insulation conforming to the following requirements:

The insulating material shall be fiberglass, cellular glass, expanded polystyrene, or urethane, and shall be covered with a waterproof jacket as specified. Section lengths and thickness shall depend on the pipe size and the

recommendations of the insulation manufacturers. Under no conditions shall the minimum total thickness be less than 75 millimeters, except when urethane is the insulating material and then the total thickness shall be no less than 50 millimeters. Unless the type of insulating material is specified the Contractor may use any one of the foregoing. However, only one type of insulating material shall be used throughout an installation.

M9.11.1 Cellular Glass.

Cellular glass insulation shall conform to the requirements of ASTM C 552, Standard Specification for Cellular Glass Insulation or revisions thereof.

The following installation accessories shall be part of this specification:

a) Stainless steel strapping, 19 millimeters x 0.38 millimeter and stainless steel clips.
b) Asphalt coated glass fabric, 0.85 millimeter x 0.85 millimeter mesh conforming to M3.06.1.

M9.11.2 Fiberglass.

Fiberglass insulation shall conform to the requirements of ASTM C 553, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications or revisions thereof.

The following installation accessories shall be part of this specification:

a) 25 millimeters galvanized wire netting.
b) Corrugated aluminum jacket, 0.5 millimeters thick.

M9.11.3 Polystyrene.

Expanded polystyrene insulation shall conform to the requirements of ASTM C 578, Standard Specification for Rigid Cellular Polystyrene Thermal Insulation or revision thereof.

The following installation accessories shall be part of this specification:

a) Stainless steel strapping, 19 millimeters x 0.38 millimeters and stainless steel clips.
b) Corrugated aluminum jacket, 0.5 millimeters thick with integral vapor barrier.
c) A suitable polystyrene adhesive.
d) Asphalt coated glass fabric, 0.85 millimeters x 0.85 millimeters mesh conforming to M3.06.1.

M9.11.4 Urethane.

Urethane insulation shall conform to the requirements of ASTM C 591, Standard Specification for Unfaced Preformed Rigid, Cellular Polyurethane Thermal Insulation or revisions thereof.

The following installation accessories shall be part of this specification:

a) Stainless steel strapping, 19 millimeters x 0.38 millimeter and stainless steel clips.
b) Corrugated aluminum jacket 0.5 millimeter thick with integral vapor barrier.
c) A suitable urethane adhesive.
d) Asphalt coated glass fabric, 0.85 millimeter x 0.85 millimeter mesh conforming to M3.06.1.

M9.11.5 Waterproof Jackets.

Waterproof jackets for covering insulation on water pipes shall be assembled as specified from any of the following materials or combinations thereof.

a) Asphalt coated glass fabric, 0.85 millimeter x 0.85 millimeter mesh conforming to M3.06.1.
b) Stainless steel strapping, 19 millimeters x 0.38 millimeter and stainless steel clips.
c) 25 millimeter galvanized wire netting.
d) Corrugated aluminum jacket, 0.5 millimeter thick.
e) Corrugated aluminum jacket, 0.5 millimeter thick with integral vapor barrier.
f) A polystyrene adhesive.

g) A urethane adhesive.

M9.12.0 Reflectors for Barriers.

An oversized yellow reflectorized cluster, diamond shape 600 millimeters x 600 millimeters and a 710 millimeter x 560 millimeter x 19 millimeter thick plywood panel shall be bolted onto barrier as directed.

The yellow reflectorized cluster (Type H1-2) shall conform to the requirements of the "Manual on Uniform Traffic Control Devices" and the approved standard detail sheets. Copies of these items are available upon request to the Department's Research and Materials Division, 400 D Street, Boston, Massachusetts 02110-1953.

The panel shall be 710 millimeter x 560 millimeter x 19 millimeter exterior type (Grade A-A, Commercial Standard PS-1).

M9.13.0 Hydrated Lime.

Hydrated Lime shall consist of a minimum of 95% calcium and magnesium oxides, pulverized so that at least 99.5% will pass a 600 micrometer sieve and at least 85% pass a 75 micrometer sieve.

M9.14.0 Preformed Expansion Joint Filler.

This specification covers nonextruding and resilient non-bituminous types of preformed expansion joint fillers and shall conform to AASHTO M 153.

M9.14.1 Preformed Compression Joint Seals (Bridges).

This specification covers the materials requirements for preformed polychloroprene elastomeric joint seals for bridges. The seal consist of a multiple-web design composed of polychloroprene and functions only by compression of the seal between the faces of the joint with the seal folding inward at the top to facilitate compression. The seal is installed with a lubricant adhesive and is designed to seal the joint and reject incompressibles. The compression seal and the lubricant-adhesive shall conform to AASHTO M 297.

M9.14.3 Polyurethane Joint Sealer.

This specification covers the requirements for a cold applied, two component, elastomeric joint sealing compound suitable for use as a joint sealer and/or caulking compound on joints in portland cement concrete or steel surfaces. This material shall meet Federal Specifications TT-S-00227E, Type I, Class A.

M9.14.4 Polyurethane Joint Sealer, Non-Sag.

This specification covers the requirements for a cold applied, single component elastomeric joint sealing compound for sealing, caulking vertical joints on bridges and other structures. This material shall meet Federal Specification TT-S-00230, Type II, Class A.

M9.14.5 Elastomeric Bridge Bearing Pads.

Elastomeric bearing pads include plain bearings (consisting of elastomer only) and laminated bearings (consisting of layers of elastomers restrained at their interfaces by bonded metal laminates). The type of bearing (plain or laminated), durometer, and dimensions will be as specified on the plans. The elastomer portion of the elastomeric compound shall be 100% virgin chloroprene (neoprene) meeting the requirements of Section 8 of the AASHTO Standard Specifications for Highway Bridges.

M9.15.0 Liquid Penetrant/Sealant.

Liquid penetrant/sealant for portland cement concrete surfaces used to protect concrete surfaces from chloride intrusion shall be a material previously approved by the Department for the purpose intended and listed on the Qualified Product Listing maintained by the Research and Materials Section, 400 D Street, South Boston, Massachusetts 02110-1953.

M9.16.1 Rubber-Cotton Duck Bearing Pad.

The bearing pads shall be manufactured of all new (unused) materials and composed of multiple layers of prestressed duck, 275 grams per square meter, duck warp count 50 ± 2 threads per 25 millimeters and filling count 40 ± threads per 25 millimeters, 64 plies per 25 millimeters of finished pad thickness, impregnated and bound with a high quality rubber compound, containing rot and mildew inhibitors and anti-oxidants, compounded into resilient pads of uniform thickness.

The pads shall withstand compressive loads perpendicular to the plane of laminations of not less than 70 MPa before breakdown. Load deflection properties in accordance with procedures of MIL-C-882 shall be the following maximum percentages of total pad thickness: 10% at 7 MPa, 15% at 14 MPa. When loaded to 10 MPa, permanent set as load is removed in accordance with procedures of MIL-C-882 shall be a maximum of 2.5% of the original "zero point" thickness. Shore Durometer shall not be less than 85 nor more than 95. The ratio of lateral expansion to vertical deflection shall not exceed 0.25 when loaded to 10 MPa. The material shall not lose effectiveness throughout a temperature range of -50 °C to 90 °C. No visual evidence of damage or deterioration by environmental effects of sunshine, humidity, salt spray, fungus, and dust in accordance with MIL-E-5272. Thickness shall be as shown on drawings within tolerances of ± 5%.

M9.16.2 Moulded Fabric Bearing Pad.

The preformed pads shall consist of a fabric and rubber body.

The pad shall be made with new unvulcanized rubber and unused fabric fibers in proper proportion to maintain strength and stability.

The surface hardness expressed in standard rubber hardness figures shall be 80 Shore A Durometer ± 10 durometer average, the ultimate breakdown limit of the pad under compression loading shall be no less than 48 MPa for the specified thickness without extrusion or detrimental reduction in thickness.

The pads shall be furnished to specified dimensions with all bolt holes accurately located.

M9.30.0 Reflective Sheeting.

Reflective sheeting shall meet the requirements of AASHTO M 268.

This specification covers flexible, retroreflective sheeting designed to reflectorize traffic control signs, delineators, barricades and other devices.

Types:

Type II - Super Engineering Grade
Type III - High Intensity Encapsulated Glass Bead
Type IV - High Intensity Unmetallized Microprismatic Element
Type VI - Flexible High Intensity

M9.30.3 Acrylic, Prismatic Reflectors and Embossed Aluminum Frames for Signs.

Shall meet the requirements of AASHTO M 290.

M9.30.4 Acrylic Plastic 82.5 Millimeter Diameter Center-Mount Reflector (Type A).

Acrylic plastic 82.5 millimeter diameter center-mount reflectors (Type A) shall be a material previously approved by the Department for the purpose intended and listed on the Qualified Product Listing maintained by the Research and Materials Section, 400 D Street, South Boston, Massachusetts 02110-1953, telephone number 1-617-

526-8686.

M9.30.6 Temporary Raised Pavement Markers.

Temporary raised pavement markers shall be a material previously approved by the Department for the purpose intended and listed on the Qualified Product Listing maintained by the Research and Materials Section, 400 D Street, South Boston, Massachusetts 02110-1953.

M9.30.7 Demountable Reflectorized Delineator-Guard Rail.

Demountable reflectorized delineators for guard rail shall be fabricated in accordance with the Standard Drawings for Signs and Supports. The panel shall conform to ASTM A 525, Steel Sheet, Zinc-Coated (galvanized) by the Hot-Dip Process, Coating Designation G210. Reflectorized sheeting shall conform to M9.30.0, Type III.

M9.30.8 Reflectorized Flexible Delineator Post.

Reflectorized Flexible Delineator Posts shall be used as directed for delineation of roadways and ramps. Only those products previously approved for the purpose intended and listed on the Qualified Product Listing maintained by the Research and Materials Section, 400 D Street, South Boston, Massachusetts 02110-1953, may be used.

M9.30.9 Reflectorized Plastic Drum.

Reflectorized plastic drums are to be used as channelizing devices in highway work zones. Drums shall be constructed of an approved ultraviolet resistant, low density, impact resistant linear polyethylene (or approved equal) with a minimum thickness of 2.4 millimeters. They shall be approximately 1 meter in height and a minimum of 450 millimeters in diameter. Drum design and application shall conform to applicable sections of the MUTCD. Reflective sheeting shall meet the requirements of M9.30.0, Type IV.

M9.30.10 Delineation for Guard Rail Termini

Delineators for Guard Rail Termini shall be fabricated in accordance with the Standard Drawings for Signs and Supports. The panel shall consist of Type A aluminum sign panel. Reflectorized sheeting shall conform to M9.30.0, Type III (High Intensity).

M9.50.0 Geotextile Fabrics.

General.

The geotextile fabric shall be a woven or nonwoven fabric consisting only of long chain polymeric filaments or yarns such as polypropylene, polyethylene, polyester, polyamide or polyvinylidene-chloride formed into a stable network such that the filaments of yarns retain their relative position to each other. The fabric shall be inert to commonly encountered chemicals, and free of defects or flaws which significantly affect its physical, and/or filtering properties.

The fabric, except wrapping placed directly against perforated pipe, shall be formed in widths of at least 2 meters. Sheets of fabric may be sewn together at the point of manufacture or other approved locations.

The geotextile manufacturer is responsible for establishing and maintaining a quality control program so as to assure compliance with the requirements of this specification.

Packaging.

During all periods of shipment and storage, the fabric shall be wrapped in a heavy duty protective covering to protect the fabric from direct sunlight, ultraviolet rays, temperatures greater than 60 °C, mud, dirt, dust, and debris.

Physical Requirements.

The fabric furnished may be either woven or non-woven, at the Contractor's option. The fabric shall meet

the requirements of Table I, Table II, Table III, Table IV, or Table V as specified for each use.

Table I – Type I Geotextile Fabric
SEPARATION

Property	Minimum Value	Test Method
Grab Strength (kN)	0.80	ASTM D 4632
Grab Elongation (%)	15	ASTM D 4632
Sewn Seam Strength (kN)	0.71	ASTM D 4632
Puncture Strength (kN)	0.31	ASTM D 4833
Trapezoid Tear (kN)	0.31	ASTM D 4533
Burst Strength (kPa)	1450	ASTM D 3786
Apparent Opening Size (mm)	Smaller than 0.6	ASTM D 4751
Permeability, k_f (cm/sec)	$k_f > k_s > 0.01$	ASTM D 4491
Ultraviolet Strength Retention (%)	70 at 150 hours	ASTM D 4355

Table II – Type II Geotextile Fabric
STABILIZATION/REINFORCEMENT

Property	Minimum Value	Test Method
Grab Strength (kN)	0.58	ASTM D 4632
Grab Elongation (%)	15	ASTM D 4632
Sewn Seam Strength (kN)	0.71	ASTM D 4632
Wide Width Strength (kN)	35	ASTM D 4595
Puncture Strength (kN)	0.18	ASTM D 4833
Trapezoid Tear (kN)	0.18	ASTM D 4533
Burst Strength (kPa)	1450	ASTM D 3786
Apparent Opening Size (mm)	Smaller than 0.6	ASTM D 4751
Permeability, k_f (cm/sec)	$k_f > k_s > 0.01$	ASTM D 4491
Ultraviolet Strength Retention (%)	70 at 150 hours	ASTM D 4355

Table III – Type III Geotextile Fabric
FILTRATION/DRAINAGE

Property	Minimum Value	Test Method
Grab Strength (kN)	0.35	ASTM D 4632
Grab Elongation (%)	15	ASTM D 4632
Sewn Seam Strength (kN)	0.31	ASTM D 4632
Puncture Strength (kN)	0.11	ASTM D 4833
Trapezoid Tear (kN)	0.11	ASTM D 4533
Burst Strength (kPa)	900	ASTM D 3786
Apparent Opening Size (mm)	Smaller than 0.6	ASTM D 4751
Permeability, k_f (cm/sec)	$k_f > k_s > 0.01$	ASTM D 4491
Thickness (mm)	0.06	ASTM D 1777
Ultraviolet Strength Retention (%)	70 at 150 hours	ASTM D 4355

Table IV – Type IV Geotextile Fabric

EROSION CONTROL/SLOPE PROTECTION

Property	Minimum Value	Test Method
Grab Strength (kN)	0.40	ASTM D 4632
Grab Elongation (%)	15	ASTM D 4632
Sewn Seam Strength (kN)	0.36	ASTM D 4632
Puncture Strength (kN)	0.18	ASTM D 4833
Trapezoid Tear (kN)	0.13	ASTM D 4533
Burst Strength (kPa)	965	ASTM D 3786
Apparent Opening Size (mm)	Smaller than 0.6	ASTM D 4751
Permeability, k_f (cm/sec)	$k_f > k_s > 0.01$	ASTM D 4491
Ultraviolet Strength Retention (%)	70 at 150 hours	ASTM D 4355

Table V – Type V Geotextile Fabric
SEDIMENT CONTROL

Property	Minimum Value	Test Method
Grab Strength (kN)	0.40	ASTM D 4632
Grab Elongation (%)	50 at 0.2 kN	ASTM D 4632
Soil Retention Efficiency (%)	75	ASTM D 5141
Puncture Strength (kN)	0.13	ASTM D 4833
Trapezoid Tear (kN)	0.18	ASTM D 4533
Burst Strength (kPa)	690	ASTM D 3786
Apparent Opening Size (mm)	Smaller than 0.84	ASTM D 4751
Permeability, k_f (cm/sec)	0.01	ASTM D 4491
Ultraviolet Strength Retention (%)	70 at 500 hours	ASTM D 4355

Notes:

Minimum values are for medium construction survivability by rating (AASHTO Task Force #25). All numerical values represent minimum average roll value (MARV) with lot sampled according to ASTM D 4354.

k_f = permeability of fabric and k_s = permeability of soil.